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BULLETIN

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New Acoustic Tide Gauge Tested

Background. The Humber Estuary is a major waterway on the east coast of England which drains about one-fifth of the area of the country. It also forms a major port complex, with about 30,000 shipping movements taking place annually. For many years a mixed system of obtaining tidal data on the Humber has been used. Float-operated tide gauges with recorders on site or with coded data passed by telemetry or telephone line have been the normal practice. These systems, and the others occasionally tried, have suffered from errors or failure in mechanical systems, blocked float tubes, distortion of analog recording, pen failures, coder unit faults and (in the case of pressure systems) density errors, and failure of underwater units. As the need to replace these gauges became more evident it was decided by the Associated British Ports authority to seek a comprehensive system which would be both cost effective and would eliminate most of the problems encountered with the earlier methods of obtaining tidal data.

The New Acoustic Tide Gauge. The new tide gauge is a direct development from an underwater sonar system. The transducer, though employed in air, is designed primarily as an underwater device, and contains seven piston-type resonators operating at 53 kHz. These give a 3-dB down beamwidth of 4 degrees (larger transducers are available where large tidal variations and rough weather are expected). The associated electronics consist of a high-power transmitter which provides a 1-kW pulse every 1/6th of a second under computer control. The receiver has a fixed gain of 40 dB and a computer-controlled gain of 80 dB in 2.5-dB steps. The received echo is demodulated and passed to a threshold circuit which provides a fast edge for measurement of the elapsed time between the transmission and the receipt of the echo. This timing function is performed by the 8-bit microprocessor which controls all the system functions.

Operation. The tide gauge transducer is mounted at the top of an open-ended plastic tube at a level above the highest attainable tide. The bottom of the tube is at a level of about 1 meter below the lowest tide. While a tube is not necessary for about 95 percent of the total time (and this would cover most survey requirements), without the tube, sound signals can be lost in gale force wind conditions. Acting as an echo-sounder in air, the system makes soundings at the rate of 6 per second. A tidal monitor containing the processor, electronic clock, battery back-up, various output connections, etc., is situated some distance away from the transducer in a convenient housing. In order to compensate for swell conditions, a selectable period of between 2 seconds and 16 minutes can be chosen during which all the soundings received are averaged and a mean level produced. A digital read-out is displayed on the monitor and, if required, a continuous analog tidal curve with digital annotation can be obtained on the site by the addition of a printer. The tidal height data can then be transmitted through modems and by telephone land lines to traffic control centers.

Accuracy. The developers of this instrument claim an accuracy of at least 0.05 percent. The high accuracy is due, to a great extent, to the fact that the system incorporates the current speed of sound in air directly into the measurement. This is done by placing a bar target into the system which is positioned 0.8 meters from the acoustic origin of the transducer. At frequent intervals, the system will select measurement of the transit time for echoes from this test target.

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